

# PATENT SPECIFICATION

829,409

DRAWINGS ATTACHED.

Inventors:—JOHN FRANCIS NUNN and ARCHIBALD CAMPBELL PINCOCK.



Date of filing Complete Specification : April 12, 1957.

Application Date : April 30, 1956. No. 13144/56.

Complete Specification Published : March 2, 1960.

Index at Acceptance :—Classes 1(1), B ; and 81(2), T1, T4(A : B).

International Classification :—A62b. G01n.

## COMPLETE SPECIFICATION.

### Apparatus for Sampling Gas Expired by a Patient.

We, THE BOARD OF GOVERNORS OF THE UNITED BIRMINGHAM HOSPITALS, a Body Corporate under the provisions of the National Health Service Act, 1946, of the 5 Secretary's Office, Queen Elizabeth Hospital, Edgbaston, Birmingham 15, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to 10 be particularly described in and by the following statement:—

During operations under an anaesthetic it is often desirable to be able to determine the carbon dioxide (or other gas) content 15 of the gas within the patient's lungs which is closest to equilibrium with the arterial blood. To do this it is necessary to sample what is known as the "End-tidal gas", that is to say the gas which is expired by the 20 patient after the "dead-space gas" (i.e. the gas in the upper respiratory tract which has not been drawn into the lungs) is expired.

The object of this invention is to provide 25 apparatus for this purpose in a convenient and efficient form.

Apparatus according to the invention comprises in combination a breathing tube, an analyser, means for inducing a flow of gas from the breathing tube, or from the 30 patient's respiratory tract to the analyser, a pressure sensitive device operable by the pressure differential between two spaced points in the breathing tube to initiate operative action of said means, and means 35 for causing a predetermined but adjustable time lag between operation of said device and the inducing of a flow of gas to the analyser.

An example of the invention will now be 40 described with reference to the accompanying diagrammatic drawing.

In the drawing 1 represents a breathing tube through which the patient is intended to inspire and expire, whilst 2 represents an analyser to which gas can be drawn through a tube 3 from the tube 1, or from the patient's respiratory tract. The analyser 2 may be of any convenient form adapted to measure the carbon dioxide, or other gas content of the gas passed to it, and incorporates a semi-permeable or other restrictive device whereby gas can only enter the analyser from the breathing tube 1, or the patient's respiratory tract when a flow is induced by other means. In the drawing 45 the means for inducing this flow comprises a suction pump or fan 4 actuated by a source of electric power 5. Alternatively a pump or fan could be situated in the tube 3 between the analyser and the breathing tube 1, or the respiratory tract. Moreover, between the analyser and the pump or fan is connected a valve 6 actuatable by a solenoid 7. 50

Two spaced points in the breathing tube 1 are connected through a pair of tubes 8 and 9 respectively to opposite sides of a diaphragm 10 of a pressure sensitive switch 11, and the arrangement is such that the pressure differential acting on opposite sides of the diaphragm as the patient expires through the tube 1 will cause the switch to close. 55

The switch 11 is in series with an adjustable resistance 12 and the coil of a relay 13 which is connected to a direct current supply from the power source 5. Energisation of the relay 13 is adapted to close the switch 14, and to move the movable contact piece of the switch 15 from the position shown to the alternative position. Moreover, a condenser 16 and a resistance 17 are connected to the fixed contacts of the switch 15 as 60 65 70 75 80 shown.

[P]